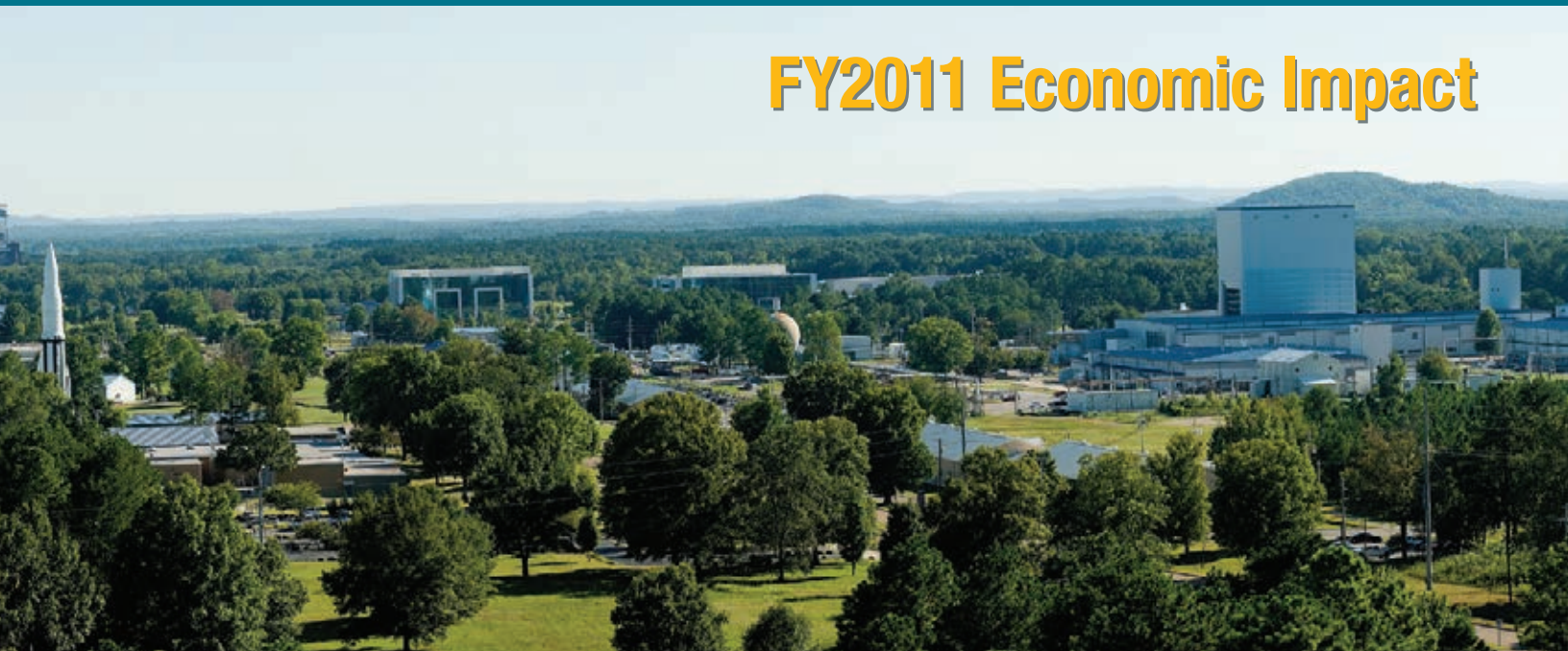
National Aeronautics and
Space Administration

marshall

NASA Marshall Space Flight Center
People, Progress and Partnerships

FY2011 Economic Impact



Marshall Space Flight Center

Launching the Future of Science and Exploration

America's journey to space began more than a half-century ago at NASA's Marshall Space Flight Center in Huntsville, Ala. Calling on this heritage of success and a drive to innovate, Marshall continues to develop solutions for space exploration that benefit life on Earth.

We develop space exploration vehicles and propulsion technologies that lift people and payloads from Earth. We manage systems that enable living and working in space. We develop and manage scientific spacecraft and instruments that help us understand our world and beyond. We support the commercial spaceflight industry and pursue partnerships with government, industry and academia to support future exploration and strengthen our nation's economy.

The economic impact from these efforts is greater than the sum of its parts. Jobs, earnings, contracts and procurements all have their impact. But the long-term return on the nation's investment in space brings innovative new technologies that continue as an economic engine of opportunity long into the future.

Lifting From Earth

Marshall is managing the development of NASA's Space Launch System (SLS) launch vehicle—the most powerful rocket ever built. The SLS is essential to fulfilling NASA's exploration vision. This heavy lifter will take astronauts deeper into space than ever before: beyond the moon, to asteroids and on to Mars.

We are developing safe, affordable, cutting-edge propulsion systems and technologies to enable both human and robotic excursions. We offer our laboratories, test sites and other cutting-edge facilities— along with our team's expertise— to commercial aerospace companies and small businesses.

Living and Working in Space

The Payload Operations Center at Marshall is the 24/7 command post for research and technology activities aboard the International Space Station (ISS). The POC manages all U.S. science experiments, coordinates with the international partners and trains astronauts and ground team flight controllers.

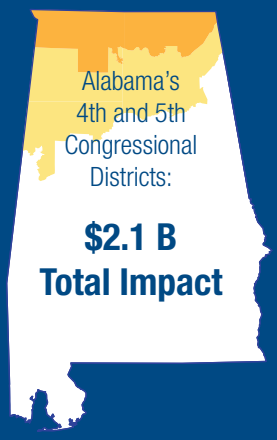
Building on expertise gained in developing the life support systems for the ISS, we are working on systems to sustain crews during the long-duration missions to come.

Understanding Our World and Beyond

Whether studying what's happening on Earth today or investigating phenomena at the edge of time itself, Marshall thrives on a strong synergy between science and exploration. Center teams use specialized scientific spacecraft and instruments and innovative research and monitoring techniques to explore our own planet and the worlds within our solar system and beyond.

Marshall's Economic Impact

Marshall affects the local, state and national economy in many ways. Procurements and expenditures include payroll, operating costs and construction outlays, all representing creation of jobs and dollars flowing into the economy.



Jobs: 4,946
Earnings: $394 M

Marshall's Impact on North Alabama

Marshall has a tremendous impact on the people of North Alabama in many ways. In terms of jobs and economic growth, the center is an engine of opportunity.

*The North Alabama data presented in this report includes the combined Fourth and Fifth Congressional Districts. In FY2011, these districts include a total of 4,946 jobs and $394 million in earnings. This includes 2,414 Marshall civil service employees with $253 million in earnings and an additional 2,532 indirect jobs with $141 million in earnings.

Marshall's expenditures in Alabama's Fourth and Fifth Congressional Districts totaled $1.2 billion for a total economic impact output of $2.1 billion.

The economic impact analysis presented here is based on research conducted by the University of Alabama's Center for Business and Economic Research (CBER).

It is important to note that MSFC had 3,255 onsite contractors plus 1,065 out-of-state for a total nationwide of 4,320 contractors. These numbers were not included in the economic impact analysis research performed by the CBER. Had these numbers been considered, the economic impact would have been much greater.

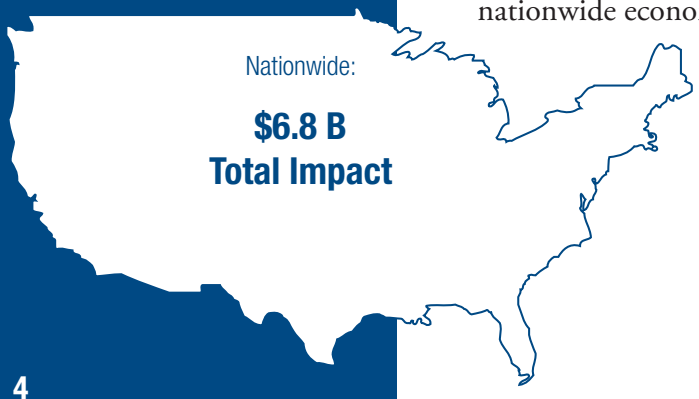
Jobs: 6,255
Earnings: $468 M

Marshall's Impact on Alabama

Marshall's economic impact in the state of Alabama includes a total of 6,255 jobs and $468 million in earnings. This includes 2,484 civil service employees with $260 million in earnings and an additional 3,771 indirect jobs with $208 million in earnings. These factors come together for a total Alabama economic impact output of $2.5 billion.

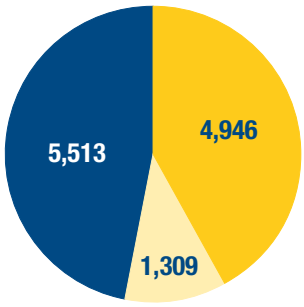
Marshall's Impact on the Nation

Marshall's U.S. impact includes 11,768 jobs across the country with total earnings of $705 million. With $2.28 billion in expenditures, Marshall's nationwide economic impact output for FY2011 was $6.8 billion.

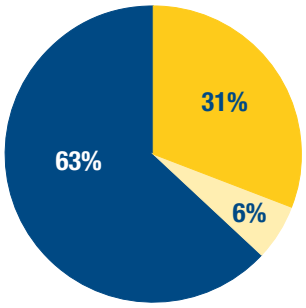


Jobs: 11,768
Earnings: $705 M

Jobs Distribution



Economic Impact Distribution



Alabama 4th & 5th Districts | Remainder of Alabama | Remainder of the Nation

Taxes Generated from Marshall's Impact

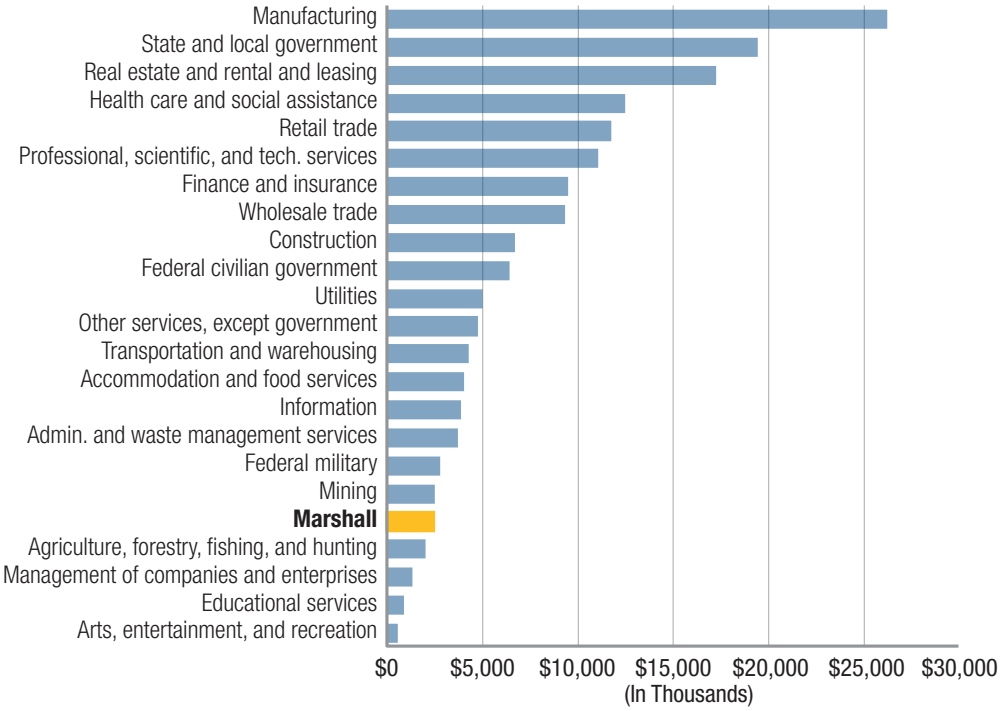
Fiscal Impact (Earnings based)	Alabama	4th and 5th Districts
Income tax (Millions)	$ 15.4	
State sales tax (Millions)	$7.5	$7.5
Local sales tax (Millions)	$9.4	$7.5
Property tax estimate (state)	$0.7	$0.6
Property tax estimate (local)	$4.5	$4.1
Total Taxes Generated	**$37.5**	**$19.7**

Marshall's Impact on the GDP

Economic impact is the contribution to gross domestic product (GDP) or the value of goods and services produced on a value-added basis.

Alabama's 2009 GDP is $167 billion, putting Marshall's contribution to the state's GDP at 1.5 percent. This chart shows how Marshall's GDP would rank among the GDP for all top level North Alabama Industry Classification System (NAICS) industry codes in Alabama. For example, Marshall's GDP is larger than Alabama's agriculture, forestry, fishing and hunting industries combined.

Alabama GDP by Industry



U.S. Bureau of Economic Analysis — www.bea.gov (FY2009 data)

**In this report, direct jobs represent the civil servant workforce, whereas the term "indirect" refers to jobs created as part of the supply chain. Their salaries and wages are described as earnings. "Total expenditures" includes earnings and all procurements.*

The combined Fourth and Fifth Congressional Districts encompass the counties of Colbert, Lauderdale, Lawrence, Limestone, Madison, and Jackson, and part of Morgan County in the Fifth District and Franklin, Marion, Lamar, Fayette, Walker, Winston, Cullman, Blount, Marshall, Etowah, DeKalb and parts of Morgan and Pickens counties in the Fourth District.

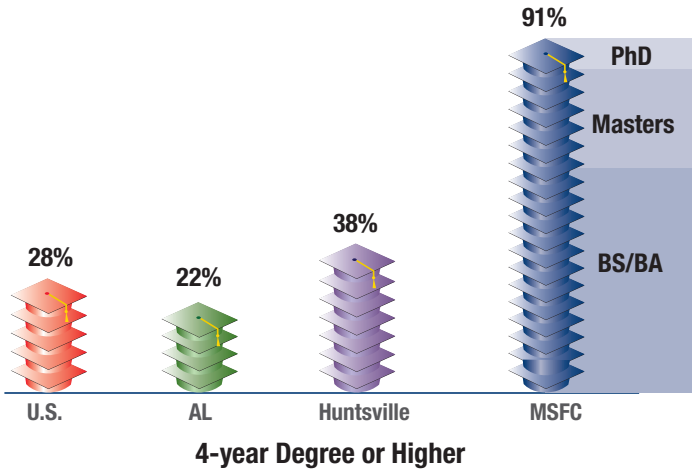
People: A Smart Place to Live, Work, and Learn

Huntsville: One of the Top 10 Smartest Cities in the World.
—Forbes, 2009

Reaching Millions—
Through the Speakers Bureau and Academic Affairs, Marshall's outreach efforts touch more than 25,000 students, educators and community members in person each year. Online visitors to the Marshall-managed NASA Education pages and the Marshall website garner more than 64 million page views annually.

Impacting Regional Education Levels

Marshall's influence on area education levels is significant. The highly technical skills employed at NASA require a well-educated workforce of both civil service employees and contractors. Ninety-one percent of the center's civil service employees hold a bachelor's degree or higher.

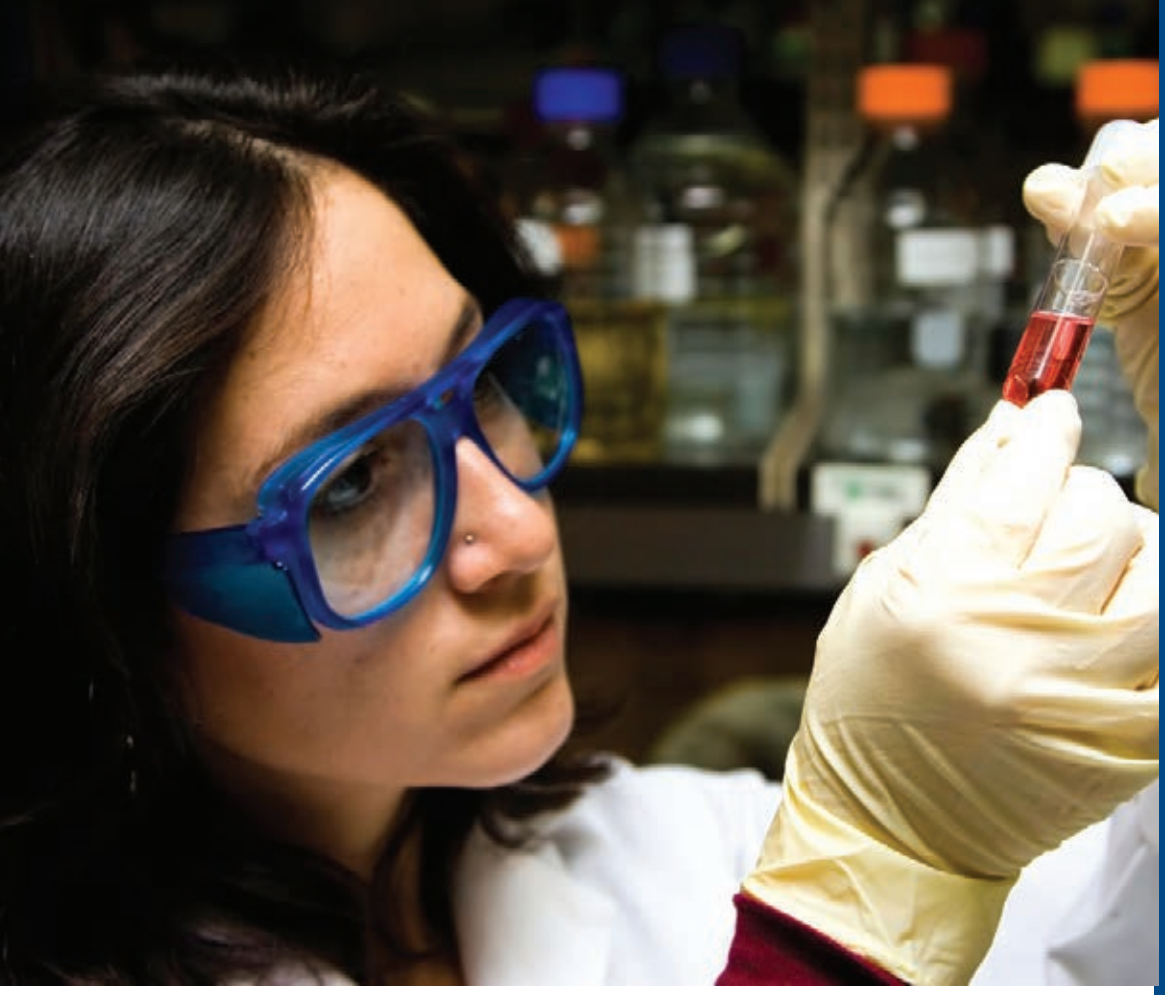


Source: http://factfinder2.census.gov

Education Outreach

NASA supports educational outreach programs to help fill the pipeline for future workers and to inspire creative innovation for America's future.

Marshall works to engage the minds of bright young people and motivate them to study science and technology so they can carry on the tradition of research and exploration. The center's education and outreach teams provide informal educational opportunities for all ages through a number of outreach programs that include:



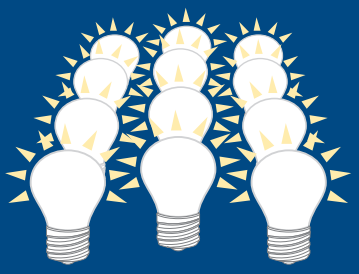
- Traveling exhibits
- College co-op and internship programs
- Speakers Bureau
- University research programs
- National Education Resource Center
- NASA Great Moonbuggy Race
- Support for the FIRST Robotics Competitions
- Student Launch Projects for Teachers

Supporting Institutions for Higher Education

By maintaining a highly educated workforce in North Alabama, NASA enhances economic growth and provides a valuable resource for businesses and the local community. To foster this growth, the agency provides educational institutions with procurements and grants for research that supports the agency's mission.

In FY2011, NASA provided nearly $30 million to Alabama educational institutions and nonprofit organizations. Marshall provided approximately $24 million of this amount. The center invested more than $124 million in academic institutions and nonprofit organizations across the country in FY2011.[1]

[1] *Source: Procurement's NPDV Ad hoc Query System*



Research Grants: $30,000,000

Giving Back to the Community

Combined Federal Campaign (CFC)

Marshall employees also improve life on Earth through their contributions to the Combined Federal Campaign. These CFC dollars help support nonprofit organizations as they provide health and human service benefits throughout the region and the world. Marshall employees participate through the Tennessee Valley CFC which is a joint effort that also includes the Army's Aviation and Missile Command and other federal agencies at Redstone Arsenal and in surrounding Alabama and Tennessee counties.

In addition to financial contributions, Marshall employees and contractors volunteer with many different area organizations such as Habitat for Humanity.

The Marshall team contributed more than $730,000 in FY2011. That is nearly 25 percent of the total Tennessee Valley CFC dollars. For the total Tennessee Valley CFC, one third of employees contributed. At Marshall, more than half (55 percent) of the center's civil service employees contributed to the campaign.

Marshall Team Reaches Out to Victims of the Deadly Storms in April 2011

In the immediate aftermath of the tragic April 2011 tornadoes that wreaked havoc across north Alabama, the Marshall team came together to help. Civil servants and contractors worked side by side to support the Federal Emergency Management Agency and local community groups to help find housing, clothing and food for victims and clean up tremendous amounts of debris.

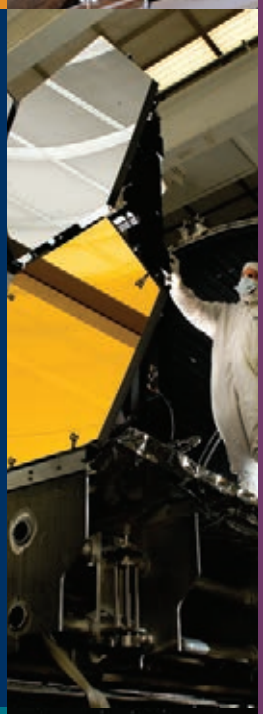
SLS: Steady Progress Toward 2017 First Flight

NASA announced the SLS architecture in September 2011, engaging U.S. industry in building America's new human-rated rocket. Consistently delivering on its commitments, the SLS team positioned RS-25 core stage engines for flight-testing, test-fired next-generation solid rocket boosters, and achieved full-duration performance data on the J-2X upper stage engine—breaking records for such an achievement in so few tests.

System Requirements Review/Definition Review milestone completion in summer 2012 moves this major initiative from design to development. Hosted at Marshall, the SLS Program is implementing widespread affordability initiatives—such as using proven technologies combined with investments in advanced technologies—to deliver a safe, affordable, and sustainable asset for NASA's mission to expand the realms of exploration and knowledge.

Science at Marshall

Marshall's diverse science portfolio includes studying Earth, our solar system and beyond. Collaborating with industry, academia, and other government organizations around the world, the Center consistently delivers on its commitments. Most recently, Marshall completed on schedule, the successful cryogenic testing of the James Webb Space Telescope (JWST) main mirror in the spring of 2012, proving itself as a reliable and responsive partner. Marshall's space science programs, such as the Chandra X-Ray Observatory, continue to provide important data to the science community. Marshall supports many low-Earth-orbiting research missions including the FASTSAT, SERVIR and SPoRT programs. These missions provide observational data to public health and safety organizations across the globe to enhance weather forecasting and environmental changes.



International Space Station

Marshall provides hardware, equipment and science management to support living and working on the International Space Station. The center managed the development and integration of connecting "nodes" that enable ISS modules to be attached. Marshall also manages the logistics modules that transport experiments to the station, and integrates experiments into rack systems such as the Materials Science Research Rack. In addition, Marshall teams developed and manage the station's life support systems.

The Payload Operations Center at Marshall coordinates all U.S. scientific and commercial experiments on the station, synchronizes payload activities of international partners and directs communications between researchers around the world and their on-board experiments.

Space Launch System (SLS)

5-segment Solid Rocket Booster Development Testing Concludes

NASA Announces Space Launch System Architecture

SLS Mission Concept Review

Begin SLS Requirements Analysis Cycle (RAC)-1 Activity

First Series of J-2X Tests Begin

Science at Marshall

Marshall's Short-term Prediction Research and Transition (SPoRT) Center Provides Unique NASA Satellite Data of April 27 Tornado Outbreak

Marshall-led Science Team Unveils Lunar Core Findings

Discovery Program's Dawn Spacecraft Begins Orbits Around Asteroid Vesta

Fast, Affordable, Science and Technology SATellite (FASTSAT) Launches From From Kodiak, Alaska

MSFC's Gamma-ray Burst Monitor Aboard Fermi Telescope Reveals Crab Nebula's Dramatic Changes

SERVIR Network Expands to Himalayan Region

International Space Station

10th anniversary of 24/7 operations in the Payload Operations Center at Marshall

Raffaello Multi-purpose Logistics Module Makes its Last Trip, Becoming a Permanent ISS Module

Microgravity Science Glovebox Exceeds 10,000 Hours of Operation

Germany, Cleveland State University and Marshall Scientists Analyze Science Materials Science Research Rack Sample Returned from the ISS on STS-133

Materials Experiments Home for Analysis

2010 Sep. Oct. Nov. Dec. | 2011 Jan. Feb. Mar. Apr. May Jun. Jul. Aug. Sep.

progress

NASA's First J-2X Engine Rockets through First Round of Testing

Marshall Conducts Tests on Orion Service Module Systems

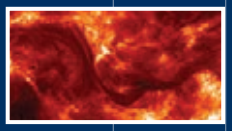
Avionics Flight Control Test-1

Completed System Requirements Review and System Definition Review

Marshall Completes Final Round of JWST Mirror Testing at MSFC's World-class XRCF

Marshall Begins JWST Center of Curvature Optical Assembly (COCOA) Testing

Chandra Finds Milky Way's Black Hole May Be Grazing on Asteroids



Marshall-developed Hi-C Telescope Captures Sharpest Images of Sun's Corona

First Astronaut Certified as a Payload Operations Director

MSFC SERVIR: Expanding Sensor Networks from the Ground to the International Space Station

May 2012
Marshall Space Flight Center Honored by the Alabama Legislature; Marshall's Acting Director Speaks to Joint Session

Oct.	Nov.	Dec.	2012 Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.

www.nasa.gov/marshallatwork

Marshall Spinoff Technologies

Our Small Business Innovation Research Program and Small Business Technology Transfer Program have contributed to technologies that alleviate chronic pain for soldiers and civilians, provide warmth to marathon runners and emergency rescue personnel, make clean drinking water available throughout the world, and suppress fires in seconds.

Technology transfer promotes commercial activity, encourages economic growth and stimulates innovation in business and commerce.

Healing Technology for Cancer Patients

NASA light technology for plant growth experiments in space eases the painful side effects of cancer treatment and aids the healing of wounds, burns and diabetic skin ulcers. The High Emissivity Aluminiferous Luminescent Substrate, or HEALS, provides the equivalent light energy of 12 suns from each of 288 LED chips — each the size of a grain of salt.

Reflecting on Space Benefits — A Shining Example

Reflective insulation technology developed to keep spacecraft and astronauts safe and functional in the extreme environment of space is now used to make insulating blankets that comfort and warm victims of natural disasters. The blankets also protect marathoners from hypothermia after their grueling races, keep football fans warm in outdoor stadiums and have even kept manatees warm in a tag-and-release research program.

Cleaning Oil Spills from Land

Phototrophic cells developed for water purification in space are now cleaning up environmentally damaging oil spills such as that from the catastrophic 2010 oil rig explosion in the Gulf of Mexico. This technology, which packs millions of photosynthetic bacteria into a single cell, also remediates wastewater systems and waste from livestock farms and food manufacturers.

High-Pressure Systems to Suppress Fires in Seconds

Rocket engine principles led to the development of a new fire hose nozzle. Under a Marshall SBIR contract, Orbital Technologies Corporation of Madison, Wis., company subsidiary HMA Fire improved the performance of its ultrahigh pressure fire suppression systems to extinguish many fires in significantly less time and using less water than traditional systems.

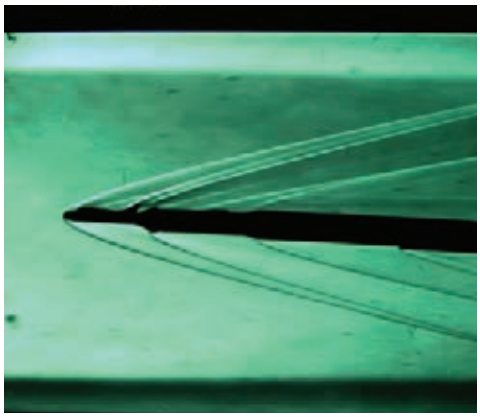
partnerships

By emphasizing long-term relationships and understanding commercial business requirements, Marshall is transforming conventional government approaches to doing business.

Marshall pursues new and innovative approaches to pair the center's capabilities with external customer needs and to pair external partner expertise with center needs. Marshall actively pursues and promotes mutually beneficial partnerships between industry, academia and other government agencies, leveraging Marshall's technology, expertise and facilities to promote technological, business and economic solutions.

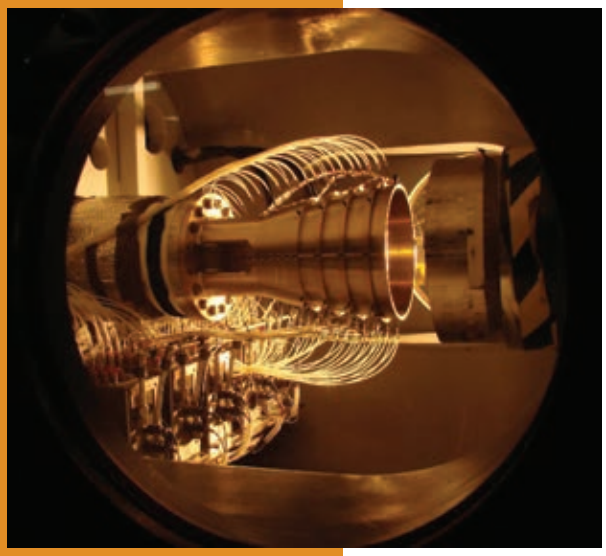
Artist rendering of SNC's Dream Chaser space plane.

One such successful partnering arrangement was with Sierra Nevada Corporation (SNC), which was in need of facilities and expertise to test a new spacecraft design for transporting crew and cargo to and from the International Space Station. Marshall's experience and unique trisonic wind tunnel offered a proven way to test the company's Dream Chaser vehicle. The result was a time and cost savings for Sierra Nevada and potential future work for the center.



Wind tunnel testing completed for two commercial spaceflight companies

Marshall offers a variety of partnership options and programs that encourage work with industry partners to spin off space technology and adapt it for cutting-edge applications across the medical, communications, safety and transportation industries and more. Marshall is also heavily involved in a NASA technology prize competition, which challenges enterprising individuals, small businesses and student groups to identify innovative solutions for technical problems of interest to NASA and the nation. In addition, Marshall manages NASA's Technology Demonstrations Mission program, which helps revolutionary, system-level technologies "bridge the gap" between laboratory development and demonstration in space.



NIRPS

In a budget-constrained environment, the nation needs integrated stewardship of propulsion capabilities to remain a world leader in aerospace. The new National Institute for Rocket Propulsion Systems (NIRPS) meets this need. Hosted at Marshall, the NIRPS is a multi-agency collaborative organization that will provide policy makers comprehensive information about the state of technology and infrastructure affecting the propulsion industry.

SLS

Marshall manages and will deliver the systems needed for the new Space Launch System (SLS). Marshall will work in unison with numerous partner companies across the country on engines, avionics, booster development and testing and other components. The first Orion spacecraft adapter, which was designed by Marshall, is being manufactured in Wisconsin. The SLS Program also includes competitive opportunities for advanced boosters and other innovations that support affordable performance enhancements. The SLS will propel exploration into entirely new realms, as the commercial industry creates the supply line to and from Earth orbit. Working together, America's future in space is unlimited.

Synergy for a Strong Economic Base

Partnerships among Marshall, Redstone and the industries in Cummings Research Park draw much recognition for the area as one of the nation's leading science and engineering communities. Marshall's unique and synergistic relationship with local industry, academia and defense agencies strengthens the area's economic base.

Marshall's relationships span beyond the local Huntsville area — as part of the Tennessee Valley Corridor (TVC), Marshall collaborates with several major universities and agencies, spanning from Redstone Arsenal to Fort Campbell, Ky., and as far-reaching as Blacksburg, Va., home of Virginia Tech. These alliances work together to solve problems and grow new business opportunities.

Huntsville Ranks as the Nation's 3rd Largest Aerospace & Defense Manufacturing Hub	August 2011 Business Facilities
Strong Growth Propels Huntsville to Alabama's 2nd Largest Metropolitan Area	February 2011 2010 Census
Huntsville's Concentration of High-Tech Workers is 2nd in the Nation only to San Jose's Silicon Valley	December 2010 TechAmerica Foundation, Cybercities Report
Huntsville Named the Nation's Best City in 2009	2009 Kiplinger's Magazine

"When the nation's space program began in Huntsville in the 1950s, it set in motion a new set of expectations to constantly look ahead and strive for improvement, and not to be content with the successes of today, but to conquer the challenges of tomorrow.

When you set that tone, it attracts smart companies and smart people. This creates a vibrant business environment where new ideas will grow and prosper for generations to come."

Huntsville/Madison County Chamber of Commerce
"Huntsville–A Smart Place" 2011

National Aeronautics and Space Administration

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www.nasa.gov/marshall

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